the base of the *down-cast* shaft it is split into two or three smaller currents, and these by means of doors and other barriers are conveyed simultaneously to all parts of the mine. A large mine will consume 100,000 cubic feet of fresh air every minute. The accompanying illustration (Fig. 2,), will serve to show how the currents of air circulate in a portion of a coal mine. The dark portions of this ground plan of the pit represent the solid pillars left for support, and the long passages, *a*, *b*, *c*, *d*, shew the waggon-ways and galleries in the long direction, while the short transverse passages are the means of communication between the long galleries. All these longitudinal and transverse passages are presumed to have free inter-communication, the only obstacles being the partial stoppages set up for directing or diverting the currents of ventilating air. In the illustration dotted lines represent such stoppages, and these are here employed arbitrarily in order to explain the different devices.

In the first long passage, *a*, no stopping is shown in the length, and therefore the air, signified by arrows, rushes straight onward to the end.

In the second long passage, *b*, a dotted line runs along to *e*, where there is a full stopping and where therefore, the arrows turn round the dotted line and shew the air current (which had been split by the partition or dotted line into two currents) returning to *b*.

In the passage *c*, the same kind of longitudinal division, or dotted line, is carried as far as *f*, and there the split current of air turns round towards *c*. But at *f*, there is a door which, when shut drives the air round the dotted line, and when open, permits the air to rush inward to *g*. Such doors are frequent in pits, and answer the purpose of allowing the transit of coal or waggons and men, and of driving back the in-rushing air immediately afterwards, and making it go back towards *c*. In the fourth passage *d*, a longitudinal division is erected for the whole length, and therefore causes the divided current to start from *d*, and when it arrives at *h*, to turn round and come back to *d*. As there are no stoppings in the transverse passages on its left, a portion of air runs up those passages, and would go on but for the stoppages at their ends. It is thus manifest how a large pit (which is but a multiplication of such portions as that illustrated) may be thoroughly ventilated in every part by the devices of stoppings and doors and other longitudinal and transverse obstacles. In the case of fiery pits (those peculiarly liable to explosions of fiery gases) a larger amount of air is necessary. The *fire-damp* or exploding gas in these mines is a light carburetted hydrogen. The precise condition in which it exists in the coal itself has not been scientifically determined. It is known, however, to exist therein in a high state of tension. Some seams, and those commonly the best for household consumption, contain it in large quantities. Hence it happens that the fiery seams are those most wrought and that particular pits have a succession of explosions in them. Still, even in the worst pits the cost of ventilation is not so great as would be supposed. It is estimated that the most dangerous pits can be thoroughly ventilated at a cost of about two cents per man per day and that in well constructed furnaces the consumption of one ton of coals per day at the bottom of an up-cast shaft will enable each collier to cut one ton of coals more per day with the same amount of exertion.

The manner of cutting the coal varies with the thickness of the seam and the nature of the coal. Where the coal is thick as in the great Dudly-thirty foot seam in England (Fig. 3) the men work in comparative comfort. In such cases it is usual for the pitmen to contract to remove so many cubic yards. They commence by digging away the base of the cube which is then propped up by timber; in the next place they cut away the sides and top, leaving only the back, which is finally charged with gunpowder and connected with a slow match. On a proper signal being given all men in its vicinity remove to safe quarters, the mine explodes and down falls the great cubical mass of coal, which is soon shovelled off and conveyed to the pit's mouth. But this is an exceptional state of affairs. The ordinary run of seams vary in thickness from nine inches to three or four feet. In such cases the work is performed by hand with the pick and our cut (Fig 4) offers some idea of the numerous tiring and painful positions the miners are obliged to assume, kneeling, stooping and lying down; great activity, also is required to change the position rapidly in order to get at the coal. Burrowing thus the miners do not remove the whole of a seam of coal but divide and intersect it by roads and passagers as shewn in (Fig 2) leaving pillars of coal to support the superincumbent strata.

This method of working is called the post and stall system. The seam is divided by what are variously called "partings," "backs," "faces," "cutters," and "ends." Besides the chief partings at the roof and floor of the coal seam, there are intermediate lines of parting or planes of cleavage, parallel to the chief partings. A reference to Figs. 4 and 5 will render this mode of working clear. The letters A, B, C, D, E, F, G represent a mass of coal, being a portion of a regular coal seam, and they are the chief partings at the roof and flooring respectively; Q, Q, Q, the intermediate "partings," or planes of cleavage; ZZ, ZZ, ZZ, the "backs"; PP, PP, the "cutters." It thus appears that a bed of coal according to the number of these planes of cleavage may be broken or subdivided into solid, cubical blocks. In this manner pillars of coal are left to support the roof, and these are subsequently removed when the whole coal field has been worked out in this form.

After driving the main levels in opposite directions upon the engine shaft, narrow mines or galleries called "bays" are drawn out of the main levels at regular intervals, at right angles to the backs, "cross-roads" or "cut-thro's" are then driven at right angles to them at every five or six yards—thus on Fig. 5 LL represents the main level; *o*, *o*, *o*, *o*, *o*, *o*, the pillars of coal supporting the roof; P, P, P the gallery; Q, Q, the cut-thro's.

The galleries are not usually at right angles to the main levels, but sometimes meet them at acute angles. This, then, is the most common manner of obtaining the coal. We alluded above to a gas which escapes in vast quantities from some species of coal and which is called by the miners fire-damp. It is from this that the greatest danger in coal-mines proceeds. This gas is extremely inflammable and when mixed with a certain proportion of air explodes with fearful violence upon ignition. It is liable to issue from the coal at any moment during the work of the hewer, who may suddenly strike his pick into a cavity where the fire-damp has been pent for ages. It rushes out with great violence and is then termed a "blower." If the ventilation is good and the men are working with safety lamps, little or no danger may be apprehended; but if naked candles are used and the current of air in the mine is sluggish, the mixture of fire-damp and air accumulating, is fired at some point and explodes with fearful violence, blowing everything before it. Those who have visited pits after one of these calamities, state that the woodwork is broken and splintered like twigs in the hands of a